International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

Autonomous Maintenance in Production Systems

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Abstract - Total Productive Maintenance (TPM) is a philosophy prepared on the basis of productive maintenance concepts and methods to improve the production. This paper aims to study the results of TPM implementation in manufacturing industries. The correlation between various TPM implementation dimensions. Manufacturing is considered to be an important element in a firm's endeavor to improve firm Performance. TPM is a highly structured approach, which uses a number of tools and techniques to achieve highly effective plants and machinery. TPM implementation helps to improve both the equipment efficiency and effectiveness of machines thus it brings appreciable improvements in other areas of the manufacturing enterprise. Total productive maintenance is one of the innovative approaches to maintenance that Optimizes equipment effectiveness eliminates breakdowns and promotes autonomous maintenance by operators through day-to-day activities involving total workforce.

Total Productive Maintenance is a key to the organization where it is helpful in standing up in the competitive market, so the scope of this project is not only on departmental level but also on the international level is essential. So our project helps to achieve partial artificial intelligence by implementing JISHU HOZEN methodology also known as Autonomous Maintenance.

1. INTRODUCTION

TPM (Total Productive Maintenance) is approach for equipment maintenance that endeavors perfect production by reducing the rejection, proper maintenance and availability of equipment and focusing toward no defect. In addition it values a safe working environment with zero accidents. It can be considered as treatment to improve the performance of machines. It accent proactive and hindrance maintenance to maximize the operational efficiency of equipment.

Total productive maintenance is a technique adopted to maximize the effectiveness of facility available for employees in our organization. It establishes a system of productive maintenance, covering the entire life cycle of equipment, covers all staffs, involves involution of all employees from higher to lower and promotes small group autonomous activities.

This to be able to take care of small maintenance pillar is geared towards developing operators tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical.

2. PROBLEM STATEMENT

As the employee is the key of any plant who runs the machines to give the productive this paper we are going to solve this problem with the help JISHU HOZEN study Safety causes the cost of the production system so the maintenance of machine may help to reduce the cost involved in the safety of operator. The root of safety problem is health hazards produced by machine and the working environment so precaution of this problem is machine maintenance to prevent the problem of safety. JISHU HOZEN study is taken under consideration to solve this problem.

Other Problem Faced- Breakdown of machines, White fugai, Red fugai, Fatigue of employee. Stability of production system.

3. STEPS OF TPM

3.1 Stage A-Preparatory stage

Step 1- Steps is taken by management of the organization to give a brief about TPM introduction in the organization: A good understanding, dedication and active involvement of the upper management in needed for this step. Senior management should be aware of programs, after which decision is made. This decision of implementing TPM is displayed on the notice boards and a letter informing the same is send to contractor and suppliers.

Step 2- Initial education and propaganda for TPM: Training is to be done based on the need. Some need hard training and some just knowledge training based on the technical knowledge of employees in maintenance.

Step 3- Setting up TPM and departmental committees: TPM includes improvement, autonomous maintenance, quality maintenance etc., as part of it. When committees are set up it should take care of all those needs.

Step 4- Establishing the TPM working system and target: Each area/work station of Power Plant is benchmarked and target is fixed up for achievement.

Step 5- A master plan required for implementation of next step: Next step is implementation of selected decisions to train the employees wherein TPM becomes an organizational culture. Achieving TPM award is the proof of reaching a satisfactory level.

3.2 Stage B-Introduction stage

A small get-together, which includes QH talbros contractor and suppliers participation, is conducted. Suppliers as they should know that we want quality supply from them. Some may learn from QH talbros

3.3 Stage C-TPM implementation

In this stage few activities are carried which are called eight key pillars in the development of TPM improvement activity. Of these four activities are for establishing the system for production efficiency, one for initial control system of new products and equipment, one for improving the efficiency of administration and are for control of safety, sanitation as working environment in QH talbros Ltd.

3.4 Stage D-Institutionalizing stage

By now the TPM implementation activities would have reached maturity stage. Now the next goal of TPM structure is to apply for preventive maintenance award. The following is the brief description of each of the TPM implementation activities:

1. Master plan: The TPM department, along with manufacturing and maintenance management, determines the scope/focus of the TPM program. The selected equipment's and their implementation sequence are determined at this point. Baseline performance data is collected and the program's goals are established.

2. Autonomous maintenance: The TPM team is trained in the methods and tools of TPM and visual controls. The equipment responsibility for cleaning and inspecting their equipment and performing basic maintenance tasks. The maintenance staff gives the instructions to the operators on how to perform the scheduled maintenance, and all are involved in developing safety procedures. The equipment operators start collecting data to determine equipment performance.

3. Planned maintenance: The maintenance department collects and analyses data to decide usage or need based maintenance requirements. A system for tracking equipment performance metrics and maintenance activities is created (if one is not currently available). Also, the maintenance schedules are combined into the production schedule to avoid schedule conflicts for a perfect planned maintenance.

4. Maintenance reduction: The data that has collected and the lessons learned from TPM implementation are shared with equipment suppliers. The maintenance department also develops plans and schedules for performing periodic equipment performance checks (oil level, fuel filter, power voltage, raw material and heat produced during operations, etc.). This data from analysis is also fed into the maintenance database to develop accurate estimates of equipment performance and repair equipment. These analyses are used to prepare spare parts inventory terms, norms and proactive replacement schedules.

4. PILLARS OF TPM-

4.1. *Health & Safety*

This is crucial as it sets the goal of zero accidents. Its importance is emphasized by the need to protect operators, who will be trained, initially, to carry out simple technical tasks. Focus on a point that most of the operators that will be participating in

AM were not employed with maintenance in mind, no matter how simple. To build confidence in the operators, they should be trained in how to carry out risk assessments. They are also encourage to help with the development of the safe working procedures.

4.2. *Education & Training*

In many companies, training is not considered as important as it deserves. Procedures are often passed on informally *on the job*, and the trainee is required to make his own shorthand notes in his log book. These are the instructions he is expected to use in the future when he carries out the tasks by himself. This seems to be highly ineffective as a training technique because it assumes

- ✓ The trainer—the *qualified* technician— actually knows the correct method;
- ✓ That the trainer can, without using a proper procedure, recall all of the steps and relevant facts in the correct order;
- ✓ That he has the ability to explain what he is doing, That the trainee is capable of understanding the topic;
- ✓ That the trainee is capable of accurate note-taking;
- ✓ That the trainee can draw proper, accurate diagrams;
- ✓ That the trainee can learn at the same time as taking notes and following instructions.

4.3. *Autonomous Maintenance (AM)*

Using skilled technicians or engineers to take very simple maintenance tasks is not cost-efficient. If operators could be trained to complete these important tasks, it gives them an

opportunity to increase their skill level, makes them more responsible for the operation of the tool, increases their job satisfaction, and frees up the technicians to work for more complex tasks including TPM teams. It also has the benefit that the cost to do the job is reduced.

4.4. *Planned Maintenance (PM)*

Planned Maintenance search for the inherent causes of equipment problems and identifies and implements root-cause solutions.

In many organizations maintenance is rarely managed, with the engineers choosing the jobs they want to tackle and using their "own experience" to carry out the work. Most technicians dislike routine maintenance as it is too repetitive and is not a challenge because they think that they already know these steps.

4.5. *Quality Maintenance*

Even what is regarded as a perfect tool will not produce perfect product. There will always be some kind of variance in the quality or the physical specifications of the product. The cause of the variation is the limitations in the equipment design and the choice of the components used. This pillar utilizes cross-functional teams to analyze areas of equipment performance where the product variation should be reduced.

4.6. Focused *Improvement*

There will be outstanding issues with equipment or processes that have been difficult to identify in the past. Cross functional teams are used to investigate the issues and to find permanent solutions. The problems under consideration have to be evaluated to justify if a fix would provide a positive, cost-effective benefit.

4.7. Support *Systems*

Every department within an organization has an impact on production: stores, purchasing, facilities, quality control, scheduling, goods in, office staff, and sales. This pillar uses TPM techniques to identify and resolve problems.

4.8. *Initial Phase Management*

This is the organizational or planning pillar. The methodology follows a kind of Value Flow Analysis. How does the company get the ideas for new products? How does it make the selection of and design of new products? How can the customers' needs and wants be better served? When the customer approaches the company, is the call handled efficiently? What about the stages between the call and the product being shipped? Is the documentation necessary and effective? Is the billing correct? Does the customer get the goods as promised and when ordered?

5. DATA RECORDED

Time consumption readings-

5.1 Reading 1

- ✓ Shift Time- 360 min
- ✓ Available time for machines-325min
- ✓ Machines availability = 90.27%

Turning Process-

- ✓ Average number of Pieces produces= 1080
- ✓ Time taken per piece =18.06sec

Finishing Process-

- ✓ Average number of Pieces produced= 1148
- ✓ Time taken per piece= 16.98

5.2 Reading 2

Turning Process-

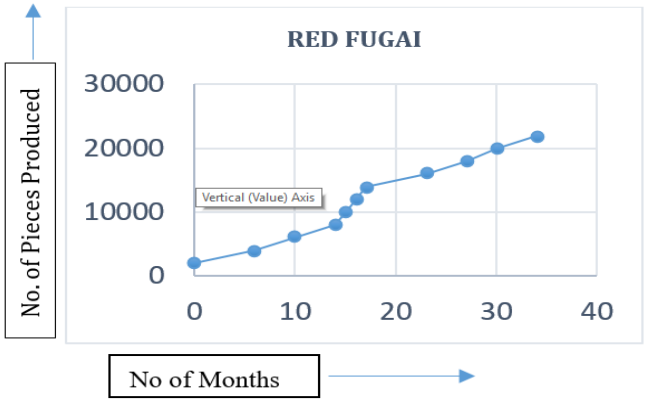
- ✓ Average number of Pieces produces= 1108
- ✓ Time taken per piece =17.59sec
- ✓ Time saved= 0.81sec,
- ✓ **Production rates increment= 2.5%**

Finishing Process-

- ✓ Average number of Pieces produced= 1192
- ✓ Time taken per piece= 16.35sec
- ✓ Time saved= 0.66sec,
- ✓ **Production rates increment= 3.8%**

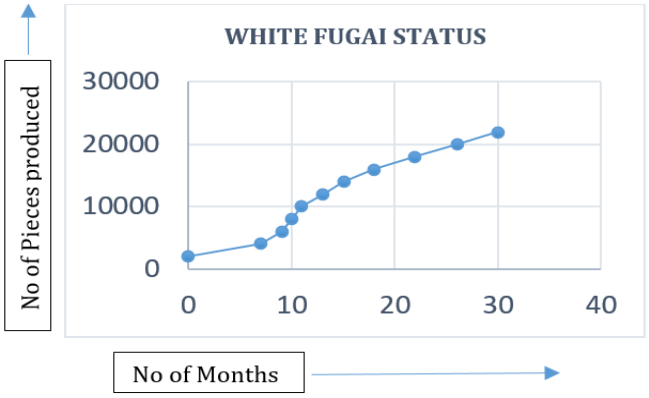
5.3 Red Fugai Status

Red fugai status can simply be explained as the defects for which we have to especially hire a technician these defect can hold the production line for hours and these defects some time are not easily removable.



5.4 White Fugai Status

White fugai can be simply explained as the defects which can be removed by appointed Operator easily, these are easily visible, these defects are not difficult to remove but removal of these defects can participate in increase of production rates.



6. CONCLUSION

In the end of the project, the production is increased by 2.5% in turning process and 3.8% in finishing process and other respective processes also by adopting JISHU HOZEN steps in production system. The JISHU HOZEN pillar of TPM has great impact on production rate.
Employee morale, Job satisfaction and safety has increased and fatigue and boredom has reduced by significant level.

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